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ABSTRACT

During the Workplace Training Project, workplace trainers from Oregon's Lane Community College (LCC) provided workplace math classes to employees of an area business, PW Pipe. The math training was designed to help employees increase their proficiency in math and thereby reduce production error rates. During the training, PW Pipe's employees learned problem-solving skills to improve their understanding of work-related math problems; reviewed and practiced basic whole number, fraction, and decimal computation skills; and solved everyday and work-related problems involving ratios and proportions. The error rates of 9 people who received the math training and 10 people who did not receive the training were compared over the period from July 1995 through August 1997 (except for 1 month during the period, for which data were missing). A significant reduction in total errors occurred between 1996 and 1997, with a marked decrease beginning about October 1996. Despite a very positive trend toward a reduction in error rates, the data did not suggest significant differences between those receiving training and those not receiving training. It was noted however, that the nontrainee group included staff with supervisory roles who only occasionally perform the tasks affected by the training. (MN)

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Evaluation Report: Reduction of Error Rates at PW Pipe

Submitted to PW Pipe and
The Workplace Training Project, Lane Community College



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Evaluation Report: Reduction of Error Rates at PW Pipe

Training to increase proficiency in math and to reduce production error rates

An objective of training throughout the three year *Workplace Training Project* has been to assist employees in developing skills that would lead to a measurable gain in key productivity indicators specific to each business partner. At PW Pipe, developing workers' math skills as a means of reducing errors in production accounting has been a goal of training since the initiation of the Project three years ago. Math classes have been conducted periodically to:

- Learn problem-solving skills to improve understanding of work-related math problems;
- Review and practice basic whole number, fractions, and decimal computation skills;
- Solve everyday problems using ratios and proportions;
- Solve a variety of work-related problems using computation and problem solving skills.

Analysis led to the identification of three types of errors: calculation, omission, and transcription. Calculation errors are those caused by mathematical errors assumed to relate to a lack of math skills. Omission errors are those caused by omitting part of the information in the production recording process. Transcription errors refer to incorrectly recording information.

Data on individual error rates for trainees and non-trainees have been maintained since training was initiated. There are many influences that might explain errors and changes in error rates, for example including changes in working conditions, production rates, employee turnover. Descriptive time series analysis was determined adequate for the purposes of the Project and company management, rather than a more invasive and expensive experimental study. Data were collected from August 1, 1994 to September 1, 1997; however, analysis covers only the period beginning July 1995 as a result of data collection problems. April 1997 is also missing from the database.

Results

Data includes 9 people who received math training at the beginning of the project, and 10 who did not. In November 1996 an additional four people were added to the group receiving math training. The figures presented, with the exception of Figure 9, compare the employees in the original training group with other employees. In Figure 9, the rate of error is compared between all people who received math training (at the start of their training), with employees who had not received training. Cautious comparison must be made between these groups, as part of the non-trainee group includes staff with supervisory roles who only occasionally perform the production tasks affected by this training. However, despite the very positive trend line toward a reduction in error rates, the data suggest no significant differences between those receiving training and those not receiving training.

Results are reported in graphs on the following pages. These data indicate:

1. A significant reduction in total errors occurred between 1996 and 1997. The trend line (Figure 1) shows a marked decrease beginning about October 1996.
2. The rate of all categories of errors declined, rather than just calculation errors (Figure 2). While this suggests that factors other than math training might be influencing the drop in errors, it is also possible that simply drawing attention to error rates through the math classes might influence errors of omission or transcription.
3. There was no significant change overall in the percentage of calculation errors to total errors, although there was significant variation from month to month (Figures 3 and 4). Figure 4 shows the percentage of trainee errors attributed to math calculation errors.
4. The reduction in errors led to a substantial reduction in cost of rework. Figure 5 tracks the cost reduction by month. Figure 6 shows the average cost of errors per month in 1997 as compared with 1996. Figure 7 gives the comparison of average monthly costs for Trainees' math errors compared across 1996 and 1997.
5. Twenty five percent (5) of the employees account for 46% of the errors. Three of these five are trainees.
6. Production volume varies from month to month. However, there was no correlation found between error rates and levels of monthly production.

Figure 1. Total errors and total trainee errors, by month.

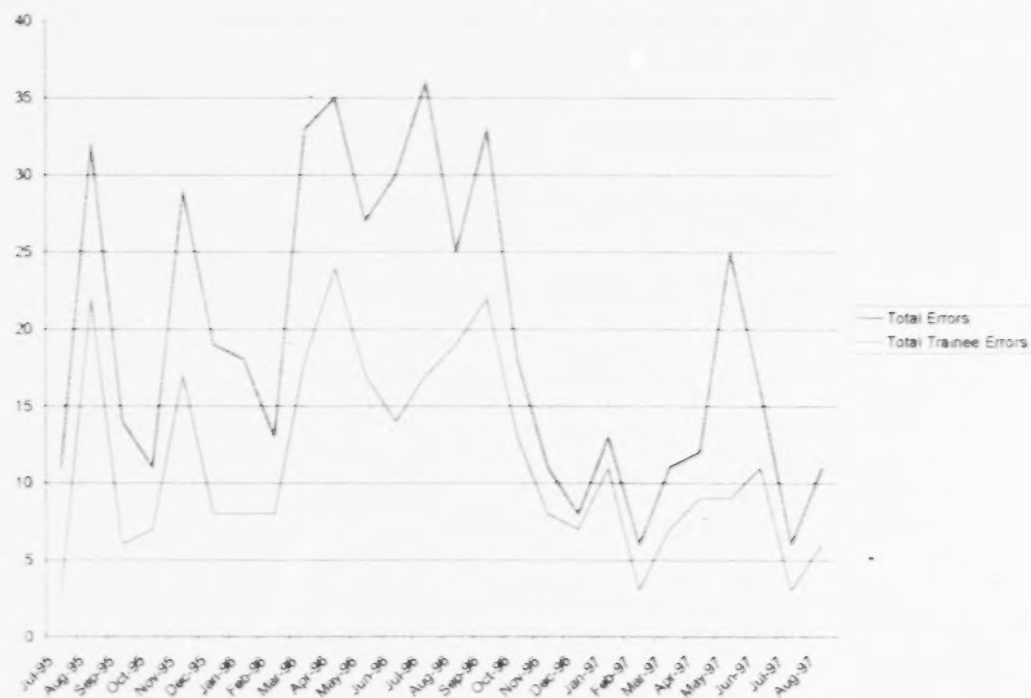


Figure 2. Total errors by type of error

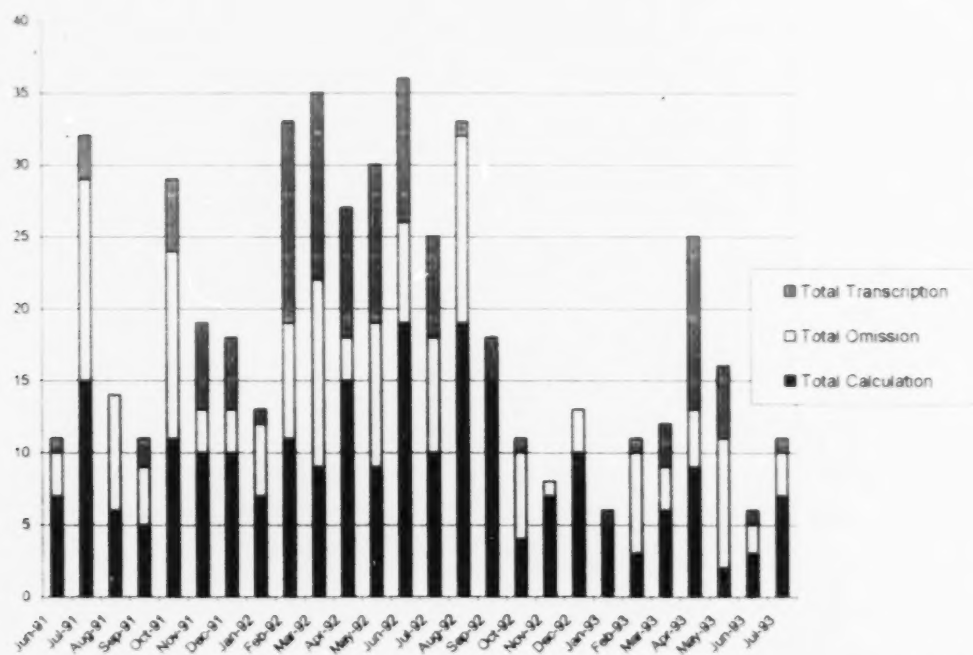


Figure 3. Error type by percent of total errors.

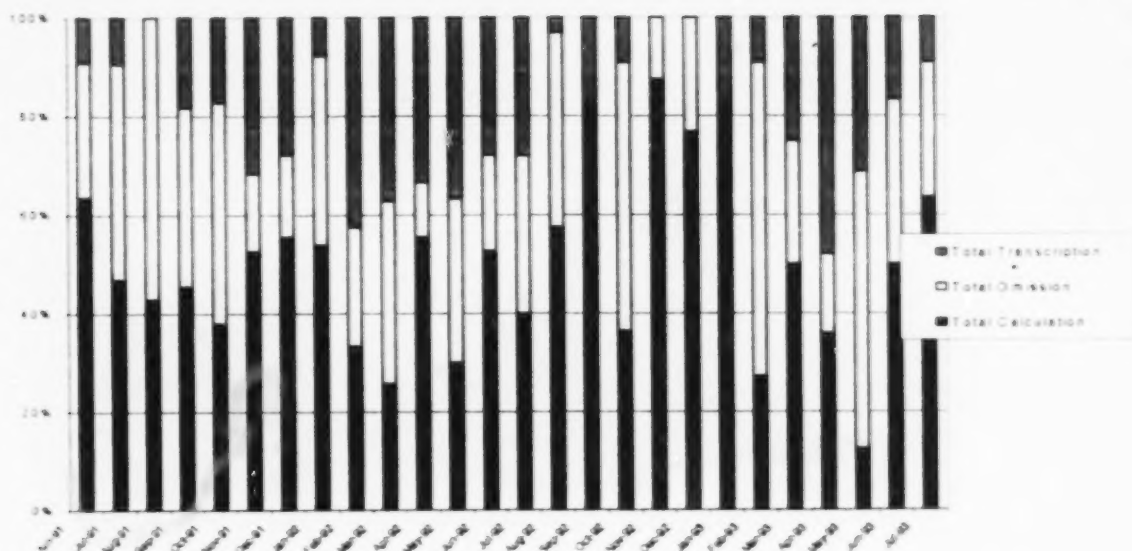


Figure 4. Percent of errors made by trainees that were attributed to math calculations, by month of project.

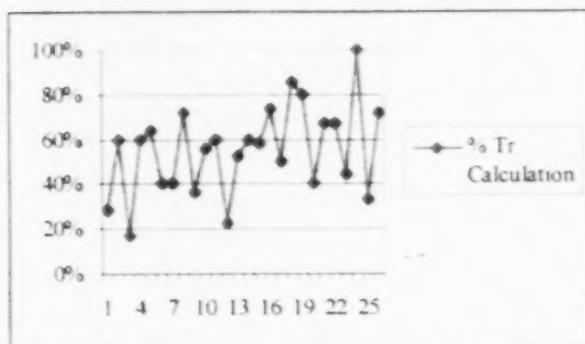


Figure 5. Economic impact of error reduction, by month of project.

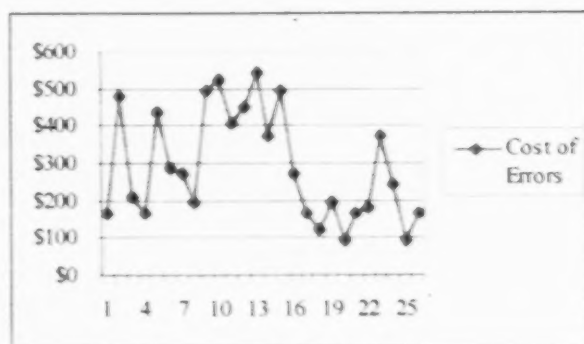


Figure 6. Comparison of 1996 and 1997 average monthly direct cost of all errors by all employees.

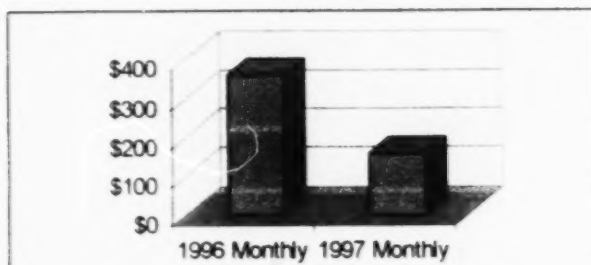


Figure 7. Average monthly costs of math errors by Trainees, 1996-1997.

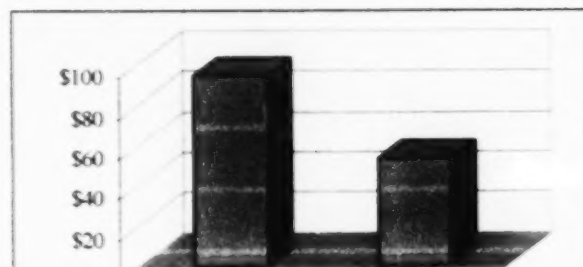


Figure 8. Percentage of total errors made by each Employee

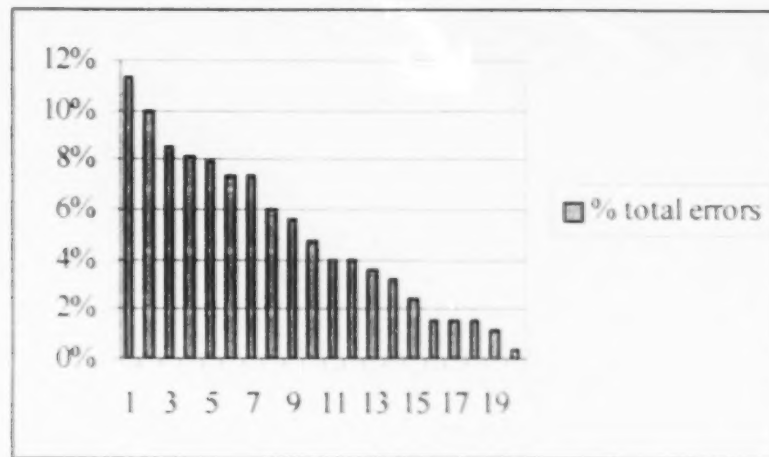


Figure 9. Error rates per employee per month of project. This figure includes the addition of the additional Employees in training as of Nov. 1996 (Month 9).

